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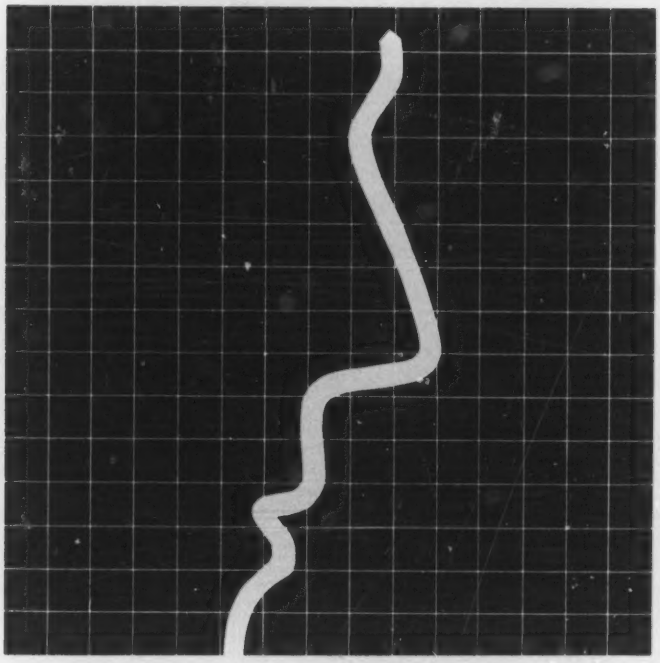
A PROFILE OF THE WOMAN ENGINEER



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Profile 1982/1

A Profile of the Woman Engineer

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Introduction

This report is based on data obtained by surveying the non-student membership of the Society of Women Engineers (SWE) during the winter of 1981-82.

The membership roll on January 26, 1982, showed 3,494 members in this category. The survey was answered by 1,846 of these members. In previous surveys the response was: 1972, 380; 1974, 462; 1977, 1,109, and 1979, 1,318

Data in this survey have been handled slightly differently than in previous surveys. Previous surveys used data only for those employed in a full-time engineering job. The responses to this survey have not been as severely restricted. The responses from male members of SWE have been removed to allow a true representation of women engineers. Responses for those who were not employed have been used where applicable, that is, degree field. These have not been used where obviously not applicable, that is, salary.

Not everyone responded to all questions; the result is some differences in total number of responses. Many of the data are presented in percentages because the information is more meaningful in that form. In some categories, the minimal number of responses makes the data irrelevant and these data are not presented.

The questionnaire used for the survey is shown in Figure 1 (pages 10-11).

Summary

This Profile of the Woman Engineer is based on responses from 1,846 of the 3,494 women who were members of SWE at the time of the survey. The majority of members have earned a bachelor's degree during the last ten years in Chemical, Civil, Electrical, or Mechanical Engineering. Those holding graduate degrees have most frequently chosen other disciplines of study.

Eighty-eight per cent of the respondents are employed full-time in engineering-related positions; only three per cent are unemployed. The balance are employed in part-time or non-engineering positions. Private industry employs 62.4 per cent of SWE members. Areas of work responsibility, primary job function, and employer product or service are quite diverse. Roughly half of the engineers have no regular supervisory responsibility, while 8 per cent serve as managers or general managers. On the average, the woman engineer earns a salary above the average engineer salary.

As indicated by their recent college graduation dates, SWE members are young. Sixty per cent are in the range of 22 through 30. Lifestyles, as indicated by marital status and family size, are varied. The number of married engineers is slightly greater than the number of unmarried engineers (single, divorced, widowed). More women engineers live in California than in any other state.

TABLE 1. *Percentage of respondents specializing in a field, shown for all degrees and then for PhD only.*

Degree	*Mechanical*	*Chemical*	*Electrical*	*Civil*	*Industrial*
All	9.2	8.8	7.1	8.6	6.0
PhD	8.0	5.0	10.0	2.0	6.0
Degree	*Computer Science*		*Metallurgical*	*Education*	*Physics*
All	6.2		3.1	1.3	0.6
PhD	9.0		10.0	8.0	6.0

Educational level and degree fields

Degree fields

Six fields of study, out of 34 possible answers, accounted for 71 per cent of the bachelor's degrees of women engineers. In order of selection these were Chemical Engineering, 17 per cent; Civil Engineering, 16 per cent; Electrical Engineering, 13 per cent; Mechanical Engineering, 13 per cent; Industrial Engineering, 7 per cent and Mathematics, 5 per cent.

Of the women answering the survey, 74.5 per cent received their bachelor's degree in the last ten years. This is to be expected when observing the ages of the majority of the respondents.

Figure 2 (page 7) shows the number of years since bachelor's degree and the number of responses.

Educational level

In response to the question concerning highest degree earned, 17 respondents reported no degree and six had an associate degree. Those holding the Bachelor's degree totaled 66.9 per cent; Master's degree, 22 per cent; Master of Business Administration, 4.3 per cent, and Doctorate, 5.6 per cent.

Those holding PhD's do not have the same distribution as those with other degrees. Table 1 (page 3) shows a comparison of disciplines for PhDs versus all degrees. The table shows that of those women engineers with PhDs, 10 per cent are working in Metallurgical Engineering whereas only 3.1 per cent of those holding lesser degrees work in this area. Those with PhDs are most frequently found in Metallurgy, Education, Electrical Engineering, Computer Science and Physics. There is a noticeable lack of PhDs in the very popular areas of Mechanical, Chemical and Civil Engineering.

There are similar trends in the Master's degree data. Those women whose main areas are Aerospace, Environmental, Metallurgy, Nuclear or Systems Engineering more frequently have master's degrees than do those in Chemical, Civil, Industrial or Manufacturing Engineering.

TABLE 2. *Percentage of response on type of employer.*

Private Industry	62.4
Consulting	9.2
Utilities	8.2
Federal Government	6.4
Educational Institutions	5.3
State and Local Governments	2.8
Other Categories	less than 2.0

Employment information

Current status

Eighty-eight per cent of the respondents to the survey reported that they were employed full-time in an engineering-related position. Four per cent were employed full-time in non-engineering work; two per cent, part-time engineering-related, and 2 per cent were retired. Less than one per cent responded in the areas of employed part-time non-engineering or in part-time student. Of those unemployed, 24 individuals stated they were seeking employment, and 26 said that they were not. The unemployed total was less than three per cent of those responding to the survey.

Type of employer

By far the largest number of women engineers was employed by private industry, 62.4 per cent. Consulting ranked second, followed by utilities.

Table 2 gives the responses to the question concerning type of employer. (See Questionnaire IV, A 2.)

The fields of specialization describing current position were headed by Mechanical, Civil, and Chemical Engineering.

Table 3 details the results of the Questionnaire IV, A 1.

Product or service

Respondents were allowed to give two answers about the product or service which best represented their employer. (Questionnaire IV, A 3.) The results show that Construction/ Civil Engineering, Aircraft/Space-craft, and Electronic Equipment represented 25 per cent of the responses. Table 4 gives further details on this question.

The most frequently mentioned area of work responsibility (IV, B 1) was Industrial Products/ Processes with 22.2 per cent, followed by Energy at 13.9 per cent.

Table 5 gives additional information concerning this question.

Primary job function

Since as many as three answers were allowed to describe job function, the statistical information is not easily presented. The category most often selected was Design, followed by equal selections of Analysis, Management, and Development. Planning stood next, followed by Consulting, Production, and Research, in a group. These were followed by Administration, and another group comprised Construction, Teaching, and Sales and Service.

To offer a better view of these data, the three blanks on the form which permitted the respondent to state primary and other job functions are described further. There were 1,710 responses to the question concerning primary job function. Answers to the second and third questions were given by 1,574 and 1,183 respondents, respectively.

The comparison of answers for the three questions is given in Table 6.

TABLE 3. *Field of specialization best representing current employer.*

Field	*Number of Responses*
Mechanical Engineering	161
Chemical Engineering	154
Civil Engineering	151
Electrical Engineering	124
Management	120
Computer Science	109
Environmental Engineering	107
Industrial Engineering	105
Aerospace Engineering	90
Manufacturing Engineering	78
Systems Engineering	75
Petroleum Engineering	62

TABLE 4. *Product or service area best representing present employer.*

Product/Service Area	*Per Cent of Responses*
Construction/Civil Engineering	10
Aircraft/Spacecraft	8
Electronic Equipment	8
Petroleum	8
Utilities	8
Computers	7
Research	7
Communication Services	6
Education and Information Services	4
Machinery/Mechanical Equipment	4
Nuclear	4
All other categories	less than 3% each

TABLE 5. *Area to which major portion of work is related.*

Area	*Per Cent of Responses*
Industrial Products/Processes	22.2
Energy	13.9
Defense	8.9
Aerospace	8.2
Consumer Products	8.2
Pollution	5.6
Utilities	5.5
Education	4.7
Transportation	4.5
Public Works	3.6
Health, Urban Development, Safety	less than 2

Supervisory functions

Two similar questions were asked about supervisory functions, but the results do not correlate completely.

The first question asked about supervisory responsibility in terms of organization, such as supervision of project or section.

The second question asked how many people were regularly supervised, such as 5 to 15 people.

To the first question, 41.4 per cent said they gave no supervision, but 50.3 per cent gave that answer for the second question. (See Questionnaire IV, B 4 and 5.) The correlation at the top of the scale was better. "Management of a major department" was answered by 5.2 per cent on the one question, and "management of 15 to 50 people" was answered by 5.4 per cent on the other. The answer to "general management" of 2.5 per cent correlates with the 2.2 per cent who managed more than 50 people. The mismatch at the "none" and lower supervisory levels is not fully explained.

While the distribution of management function does correlate reasonably well with the work experience of the respondents, exact data will require that the question be stated more clearly.

Table 7 details the responses to these two questions on supervision.

TABLE 6. *Primary job function and other job functions.*

	Number of Responses		
Job Functions	*Primary*	*Second*	*Third*
Administration	74	106	77
Analysis	222	235	130
Consultation	106	128	98
Construction	50	55	49
Design	314	247	110
Development	203	187	166
Management	279	174	108
Planning	93	183	202
Production	146	79	81
Research	90	118	99
Sales/Service	43	25	28
Teaching	64	31	31
Other	26	6	4
Totals	1,710	1,574	1,183

TABLE 7. *Supervisory responsibility and number supervised.*

Supervisory responsibility	*Per Cent of Responses*
No regular supervision given	41.4
Indirect or staff supervision	22.6
Supervision of team or unit	11.7
Supervision of project or section	16.4
Management of major department	5.2
General management of organization	2.5
Number of People Regularly Supervised	
None	50.3
1 to 5	33.0
5 to 15	9.1
15 to 50	5.4
More than 50	2.2

Salary information

Engineering income

The salary information obtained from the survey reveals that, on the average, the woman engineer earns more than the average engineer's salary. This information is obtained by comparing data from the SWE survey with data from the 1981 "Professional Income of Engineers", a survey conducted by the Engineering Manpower Commission of the American Association of Engineering Societies, Inc.

Figure 3 shows the median salary and the upper quartile salary from the AAES survey, as compared with the average salary from the SWE survey based on number of years since BS degree.

The AAES uses the "years since BS" for all of its data, because this tends to blend data for persons with different degree-levels. That is, a person who takes a higher degree will generally start to work at a higher salary than one with a BS. The extra time getting a graduate degree is therefore equivalent to the same amount of work experience time. While this is not universally true, it is accurate enough to use for the SWE survey and gives a good comparison with a survey of more than 150,000 engineers.

The upper quartile salary from the AAES survey represents the salary level of the top 25 per cent of its survey; that is, 25 per cent of the AAES respondents earn that salary or better. A similar breakdown of information with the SWE survey was not made. In fact, any further breakdown of the SWE data becomes questionable because of the limited number of responses.

Table 8 (page 8) shows average salary and number of years since BS degree for all SWE survey responses.

Two points should be mentioned in interpreting the data. First, the questionnaire contained a date of December 1980, instead of 1981, for

FIGURE 2. *Years since BS versus number of responses.*

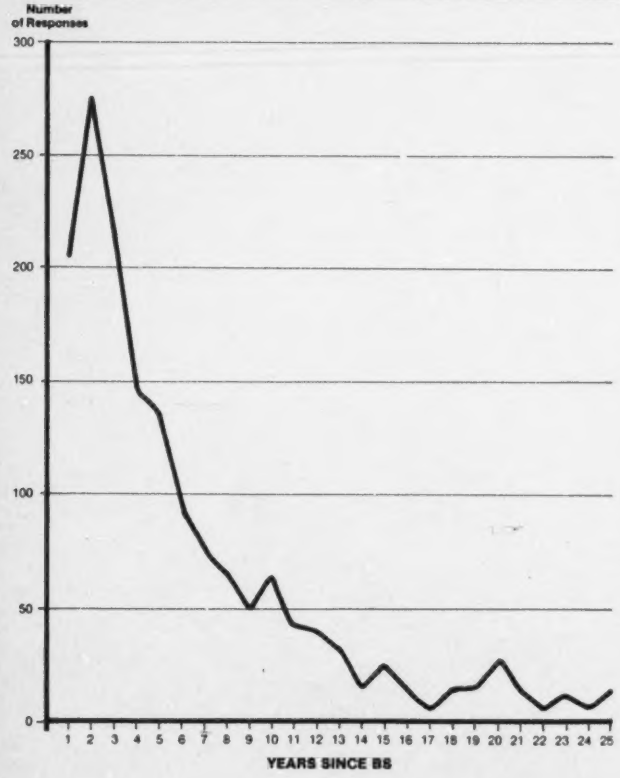
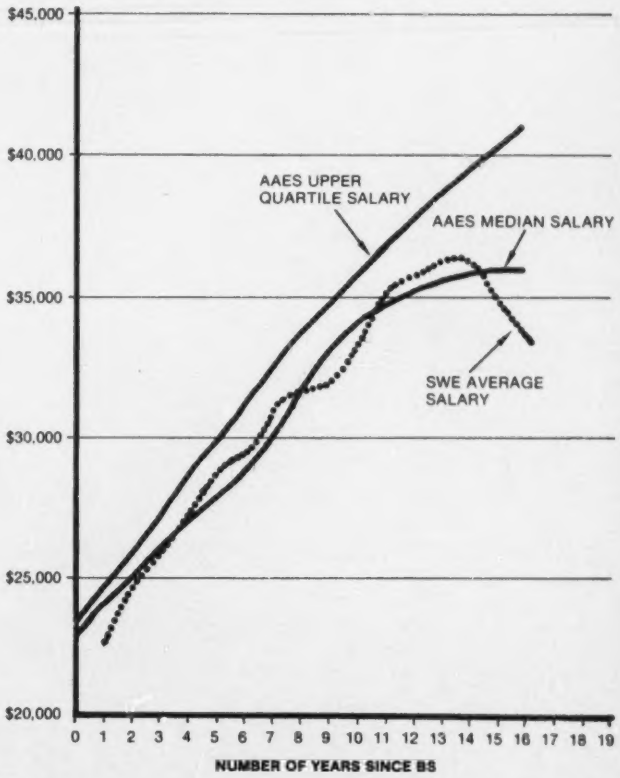


FIGURE 3. *Average SWE salary compared with median and upper quartile data from AAES survey.*



reporting salary. It is not known how many people answered the question for 1980 instead of 1981. This could cause a low salary answer. Also, anyone with less than one year since the BS degree was lumped into the "one year since BS" category. The AAES survey has a "zero year" set of data. Thus, the first-year salaries in the SWE survey are artificially low as compared with the AAES survey.

Also shown in Table 8 are data for other categories. In the data from "All" respondents, data are reported for 15 years since BS degree. Beyond this, too few answers exist to be statistically meaningful. This is clearly indicated by the number of respondents shown with each salary figure. For all other categories, the lack of statistically accurate data precludes presenting data beyond any shown on the table.

The other categories shown include that for Private Industry. This is shown for "15 years since BS" to be compared with "All" answers. Since more than 62 per cent of the responses were in that area and the next area, Consulting, had only 9.2 per cent, the Consulting and any other areas have too few respondents per year to present. In assessing the All versus Private Industry, it is clear that the other categories cause the salary figure for All to be less than Private Industry. Thus the data from Consulting, Government, Education, and so on are less than that of Private Industry.

The other categories shown are for fields of specialization answered on the questionnaire and presented in Table 3. Of these, Chemical Engineering specialization shows higher salaries for all years than do the other fields. This is in agreement with specialization data from the AAES survey. Information for other specializations is unreliable because of the low number of responses per year per category.

General

Membership grade

The national membership records of SWE on January 26, 1982, showed that 76.6 per cent of the 3,494 non-student members held the "Member" grade. The response to the survey showed that 79.3 per cent of those responding held the "Member" grade.

A comparison between national SWE data and the survey is shown in Table 9 for all membership grades.

Age of members

The youngest woman engineer in the survey was 22 and the oldest was 84. More members are 25 years old than any other age, followed by 26, 27, 24 and 28. The ages 22 through 30 years represent 60 per cent of the population of women engineers.

Table 10 is a breakdown by age of those who responded to the survey.

TABLE 8. *Average salary and number of responses by years since BS degree.*

Years Since BS	*All (K$)/(No.)*	*Private Industry (K$)/(No.)*	*Mechanical (K$)/(No.)*	*Chemical (K$)/(No.)*	*Civil (K$)/(No.)*	*Electrical (K$)/(No.)*
1	22.8/198	23.0/131	22.9/22	25.0/21	23.5/15	23.5/21
2	24.9/265	25.6/187	25.4/34	26.2/23	22.0/26	24.7/24
3	26.2/213	26.7/142	25.5/24	26.8/20	24.6/28	25.8/17
4	27.7/142	28.3/96	28.6/9	29.7/19	25.9/24	26.8/6
5	29.0/130	30.1/94	27.5/11	30.9/21		
6	29.3/84	30.8/58	26.8/8	29.9/12		
7	31.9/76	32.4/43		35.3/7		
8	31.5/60	32.4/36				
9	31.8/50	33.7/27				
10	33.9/56	35.4/27				
11	35.5/40	36.8/19				
12	35.7/39	34.7/24				
13	36.7/25	37.7/14				
14	35.6/16	45.2/5				
15	35.5/22	34.3/11				

Marital status and children

The woman engineer represents a number of lifestyles. Of the 1,807 women who answered the question on marital status, 936 were married, 697 single, 154 divorced and 20 widowed. Of those 30 and younger, nine per cent had children and 80 per cent of these had only one child. For those 31 and older, 50 per cent had children; of these 72 per cent had one or two children. The remainder had families of three to seven children.

Registration and technical societies

Most of the women engineers are not registered. The respondents indicated 58.9 per cent who had no registration, 29.5 per cent who had the EIT and 11.6 per cent who had their PE registration.

An overwhelming majority, 77.7 per cent, of the women engineers belonged to another technical society in addition to the Society of Women Engineers.

Locations

As many women engineers live in California as in Texas, New York and Pennsylvania combined. These states had the largest number of women engineers: California, 18.6 per cent; Texas, 7 per cent; New York, 6.4 per cent, and Pennsylvania, 5.6 per cent.

Figure 4 shows the distribution of women engineers over different regions of the country. In addition, the survey showed 12 women SWE members in Puerto Rico and 21 in foreign countries.

TABLE 10. *Age of respondents.*

Age group	*Per cent*
70 or older	1.0
60-69	2.3
50-59	7.5
40-49	8.6
30-39	25.9
20-29	54.6

TABLE 9. *Percentage in each SWE membership grade.*

Member Grade	*SWE Data*	*Survey Data*
Honorary/Award Member	0.8	0.7
Fellow Member	0.7	1.1
Senior Member	13.3	14.9
Member	76.6	79.3
Associate	8.8	4.2

FIGURE 4. *Number of responses from different areas of the U.S.A.*

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FIGURE 1. *Questionnaire for survey.*

SOCIETY OF WOMEN ENGINEERS
United Engineering Center, Room 305
345 East 47th Street
New York, New York 10017

SURVEY OF THE WOMAN ENGINEER
Conducted by
The Statistics Committee

Membership Grade (check one)
- Hon/Award Winner ☐
- Fellow ☐
- Senior Member ☐
- Member ☐
- Associate ☐
- Student ☐

This questionnaire is being sent to all members of SWE to obtain information for the bi-annual SWE publication entitled, "A Profile of the Woman Engineer." You will be assisting the Society, the profession, other women, and yourself by completing the questionnaire and returning it to reach this office by January 5, 1982. Please be assured that this survey is entirely anonymous. It is not necessary to sign your name or otherwise disclose your identity.

I. Basic Information

A. Personal Information

1. Year of Birth ☐☐☐☐ 2. Citizenship ☐ 1-USA ☐ 2-Non-USA 3. Sex ☐ 1-Female ☐ 2-Male

4. Marital Status ☐ 1-Married ☐ 2-Single ☐ 3-Divorced ☐ 4-Widowed 5. Number of Children ☐☐

B. Additional Information

1. Are you a member of other technical societies such as ASME, IEEE? . . . . . ☐ 1-Yes ☐ 2-No

2. List first three digits of your zip code . . . . . ____

3. Are you registered by a state board of engineering examiners? . . . . . ☐ 1-Yes PE ☐ 2-Yes EIT ☐ 3-No

4. Gross income (before taxes) including salary, commissions, and bonuses or fees but excluding that part of your income which has no relationship to your work such as bonds, stocks, rents, investments, inheritances, etc. If your income is for less than full-time employment, please indicate equivalent full-time salary. Income should be for year ending 12-31-80.

☐☐☐☐☐☐

II. Employment Information

A. Current Employment Status

1. Full Time:	☐ 1-Engineering Related	☐ 2-Nonengineering Related
2. Part Time: Non-Student	☐ 3-Engineering Related	☐ 4-Nonengineering Related
Student	☐ 5-Engineering Related	☐ 6-Nonengineering Related
3. Unemployed:	☐ 7-Seeking Employment	☐ 8-Not Seeking Employment
	☐ 9-Full-Time Student	☐ 10-Retired

B. If unemployed or employed part-time and seeking employment, what type of position are you seeking?

(check one) ☐ 1-Engineering Related ☐ 2-Nonengineering Related

(check one) ☐ 1-Full-Time ☐ 2-Part-Time ☐ 3-Temporary

C. Employment History

1. Years since Bachelor's Degree ☐☐
2. Years in further full-time study ☐☐
3. Years employed, engineering ☐☐
4. Years employed, nonengineering ☐☐
5. Years involuntarily unemployed ☐☐
6. Years unemployed by choice ☐☐
7. Years retired ☐☐

III. Academic Information

A. What is highest degree earned?

- ☐ 01 None
- ☐ 02 Associate
- ☐ 03 Bachelor
- ☐ 04 Masters
- ☐ 05 MBA
- ☐ 06 Doctorate

B. For each degree earned give year, degree level and curriculum. (Use list at top of next page for curriculum; use list above for degree code.)

Yr	Deg	Curr

Yr	Deg	Curr

Yr	Deg	Curr

Yr	Deg	Curr

Yr	Deg	Curr

Yr	Deg	Curr

Curriculum/specialization list:

01-Aerospace Engineering
02-Agricultural Engineering
03-Architectural Engineering
04-Automation/Control
05-Biochemical Engineering
06-Biomedical Engineering
07-Biology
08-Chemistry
09-Chemical Engineering
10-Civil Engineering
11-Communications
12-Computer Science
13-Education
14-Electrical Engineering
15-Electronics Engineering
16-Engineering (General)
17-Engineering Science
18-Environmental/Sanitary Engineering
19-Geological Engineering
20-Industrial Engineering
21-Management/Business Administration
22-Manufacturing Engineering
23-Mathematics
24-Mechanical Engineering
25-Metallurgical Engineering
26-Mining Engineering
27-Naval Arch/Marine Engineering
28-Nuclear Engineering
29-Petroleum Engineering
30-Physics
31-Systems Engineering
32-Transportation Engineering
33-Other Engineering (Specify)
34-Other Nonengineering (Specify)

IV. Specialization/Responsibility

A. Employer Information

1. Field of specialization which best describes your present position (see list above). . . . . ☐☐

2. Give the category which is most appropriate for your principal employer in your present position . . . . . ☐☐ (see list below).

01-Private Industry or Business
02-Self-Employed
03-Consulting
04-College or University
05-Junior College or Technical Institute
06-Secondary, Elementary or Other School
07-Nonprofit Organization (other than school)
08-Federal Government-Civilian Employee
09-Military Service
10-State Government
11-Local Government
12-Utilities
13-National Laboratory
14-Other (Specify)_____

3. Give the product(s) or service area(s) which best describe your present employer. . . . . ☐☐, ☐☐

01-Agriculture and Food
02-Aircraft/Spacecraft
03-Ceramics
04-Chemicals/Allied Products
05-Communications Service
06-Computers
07-Construction/Civil Engineering
08-Education & Information Services
09-Electrical and Equipment
10-Electronic Equipment
11-Machinery/Mechanical Equipment
12-Metal Fabricated Products
13-Metals (Basic)
14-Mining
15-Motor Vehicles
16-Nuclear
17-Ordinance
18-Petroleum
19-Research
20-Transportation
21-Utilities
22-Conglomerate
23-Other (Specify)

B. Work Responsibility

1. Which area is a major portion of your work related to? . . . . . ☐☐

01-Health
02-Public Works
03-Urban Development
04-Pollution
05-Defense
06-Aerospace
07-Transportation
08-Energy
09-Consumer Products
10-Education
11-Industrial Products/Processes
12-Utilities
13-Safety
14-Telecommunications
15-Other (Specify) _____

2. Which is your principal job function? (see list below) . . . . . ☐☐

3. Give other job functions which you perform. . . . . ☐☐ ☐☐

01-Administration
02-Analysis
03-Consultation
04-Construction
05-Design
06-Development
07-Management
08-Planning
09-Production
10-Research
11-Sales and Service
12-Teaching
13-Other (Specify) _____

4. Describe your present supervisory responsibilities . . . . . ☐☐

01-No regular supervision given
02-Indirect or staff supervision
03-Supervision of team or unit
04-Supervision of project or section
05-Management of major department, division or program
06-General management of organization

5. Number of people regularly supervised.

☐ None ☐ 1 to 5 ☐ 5 to 15 ☐ 15 to 50 ☐ over 50

Thank you for your cooperation. Please return the questionnaire to the Society of Women Engineers in the enclosed, addressed envelope by January 5, 1982 .
date

Credits

This 1982 edition of *A Profile of the Woman Engineer* was prepared by the 1981-1982 and 1982-83 Statistics Committees. It is intended for use in planning the direction of the Society and for informing members and others about women in engineering.

Additional copies of the Profile are available from SWE Headquarters, Room 305, 345 East 47th St., New York, NY 10017 for $1.00 per copy.

The Statistics Committee especially wishes to thank Debby and Steve Smith for the use of their personal computer, for many hours of data entry, and for writing the program used to sort the survey responses.

Thanks are also due to Bruce Jackson and Ivy Hooks for the use of their personal computer and to the many members of the Houston Area Section who generously gave their time to enter the survey responses into the computers.

Statistics Committee

1981-1982	1982-1983
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The Society of Women Engineers appreciates the continuing interest and support of the American Telephone and Telegraph Company (AT&T) and thanks the company for its support in publishing this edition of *A Profile of the Woman Engineer*.

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